

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Davis, et al.	§	Case: 6716/ETCH/SILICON
Serial No.: 10/674,568	§	Filed: September 29, 2003
Examiner: Ram N. Kackar	§	Group Art Unit No. 1763
Confirmation No.: 3852	§	
Title: METHOD AND SYSTEM FOR MONITORING AN ETCH PROCESS	§	
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MAIL STOP APPEAL BRIEF-PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

**RESPONSE TO NOTIFICATION OF NON-COMPLIANT APPEAL BRIEF
DATED JANUARY 8, 2009**

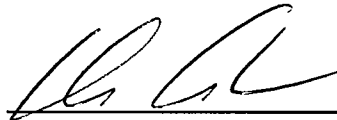
Applicants submit this Response to the Notice of Non-Compliant Appeal Brief mailed January 8, 2009. This Response is believed to be timely since filed by the due date of February 8, 2009, as set by mailing of the Notice of Non-Compliant Appeal Brief on January 8, 2009. Please charge any additional fees that may be required to make this response timely and acceptable to Deposit Account No. 20-0782.

COMMENTS

The Appeal Brief filed on December 9, 2008 was deemed defective, as the Office asserts that Item (4) of Summary of Claimed Subject Matter did not clearly map the independent claims on appeal to the specification by page and line number and to the drawings. In response to the Notice of Non-Compliant Appeal Brief mailed January 8, 2009, Applicants submit the attached revised Summary of Claimed Subject Matter.

Respectfully submitted,

Jan 15, 2009



Keith P. TABOADA
Attorney Reg. No. 45,150
(732) 530-9404

Patterson & Sheridan, LLP
595 Shrewsbury Avenue
Suite 100
Shrewsbury, NJ 07702

Summary of Claimed Subject Matter

Claimed embodiments of the invention provide a method and an apparatus for monitoring an etch process. (Abstract). In the embodiment of independent claim 1, a method for monitoring an etch process includes (a) performing pre-etch critical dimension (CD) measurements (206, Figure 1, 3A-3B, 9A, Paragraphs 34, 50) of a substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34, 50) to generate pre-etch measurement information, (b) applying an outlier filter (13, 105, Figure 1, 2A, Paragraphs 38 and 54) to remove outliers in the pre-etch measurement information, (c) analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50) and to determine process parameters to an etch process; (d) providing the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50) along with the pre-etch measurement information to an etch reactor (1000, Figure 10, Paragraphs 104-111), (e) etching the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50) in the etch reactor (1000, Figure 10, Paragraphs 104-111) to form structures (250, Figure 9A-B, Paragraphs 88, 91 and 94) in the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50) using the etch process, wherein the pre-etch measurement information in combination with etch process monitoring are used to in-situ monitor an etch process endpoint, wherein the etch process monitoring comprises directing radiation onto the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50), wherein an intensity of the radiation is modulated at a frequency of about 10 Hz, and collecting a portion of the radiation (R1-R9, Figure 3B, Paragraphs 41, 55, 58 and 60) reflected from the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50) to determine critical dimension (216, Figure 3B, Paragraphs 41, 55, 58 and 60) of the structures (250, Figure 9A-B, Paragraphs 88, 91 and 94) formed in the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50), and terminating the etch process based on the etch process monitoring having identified that the etch process has reached the etch process endpoint.

In the embodiment of independent claim 18, a method for monitoring an endpoint of a mask trimming process includes (a) performing pre-etch critical dimension (206, Figure 1, 3A-3B, 9A, Paragraphs 34, 50) measurements of a substrate (75, 200, Figure

1A-B, 3A, Paragraphs 34 and 50) having a mask (210, Figure 3A, 9A-B, Paragraphs 48-53) thereon to generate pre-etch critical dimension measurement information of such mask (210, Figure 3A, 9A-B, Paragraphs 48-53), (b) applying an outlier filter (13, 105, Figure 1, 2A, Paragraphs 38 and 54) to remove outliers in the pre-etch critical dimension measurement information, (c) analyzing the pre-etch critical dimension measurement information (206, Figure 1, 3A-3B, 9A, Paragraphs 34, 50) to determine that the mask (210, Figure 3A, 9A-B, Paragraphs 48-53) is of a sufficient quality to allow for etching of the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50) and to determine process parameters to an etch process, (d) providing the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50) along with the pre-etch critical dimension measurement information (206, Figure 1, 3A-3B, 9A, Paragraphs 34, 50) to an etch reactor (1000, Figure 10, Paragraphs 104-111), (e) trimming the mask (210, Figure 3A, 9A-B, Paragraphs 48-53) using the etch process, wherein the pre-etch critical dimension measurement information (206, Figure 1, 3A-3B, 9A, Paragraphs 34, 50) in combination with etch process monitoring are used to in-situ monitor the trimming the mask (210, Figure 3A, 9A-B, Paragraphs 48-53), wherein the etch process monitoring comprises directing radiation (R1-R9, Figure 3B, Paragraphs 41, 55, 58 and 60) onto the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50), wherein an intensity of the radiation (R1-R9, Figure 3B, Paragraphs 41, 55, 58 and 60) is modulated at a frequency of about 10 Hz, and collecting a portion of the radiation (R1-R9, Figure 3B, Paragraphs 41, 55, 58 and 60) reflected from the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50), and terminating the trim process when the etch process monitoring indicates that the mask (210, Figure 3A, 9A-B, Paragraphs 48-53) has been trimmed to pre-determined dimensions (216, Figures Figure 3B, Paragraphs 41, 55, 58 and 60).

In the embodiment of independent claim 50, a method for monitoring an endpoint of a mask trimming process includes performing pre-etch measurements (206, Figure 1, 3A-3B, 9A, Paragraphs 34, 50) of a substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50) having a patterned mask (210, Figure 3A, 9A-B, Paragraphs 48-53) thereon to generate pre-etch measurement information (206, Figure 1, 3A-3B, 9A, Paragraphs 34, 50) of such mask (210, Figure 3A, 9A-B, Paragraphs 48-53), wherein the pre-etch

measurements (206, Figure 1, 3A-3B, 9A, Paragraphs 34, 50) include width of structures comprising the patterned mask (210, Figure 3A, 9A-B, Paragraphs 48-53), applying an outlier filter (13, 105, Figure 1, 2A, Paragraphs 38 and 54) to remove width outliers in the pre-etch measurement information (206, Figure 1, 3A-3B, 9A, Paragraphs 34, 50), providing the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50) along with the filtered pre-etch measurement information (206, Figure 1, 3A-3B, 9A, Paragraphs 34, 50) to an etch reactor (1000, Figure 10, Paragraphs 104-111), (d) determining process parameters of an etch process in response to the pre-etch measurement information (206, Figure 1, 3A-3B, 9A, Paragraphs 34, 50), (e) trimming the mask (210) using the etch process, wherein the filtered pre-etch measurement information (206, Figure 1, 3A-3B, 9A, Paragraphs 34, 50) in combination with etch process monitoring are used to in-situ monitor trim process, wherein the etch process monitoring comprises directing radiation (R1-R9) having an intensity modulated at a frequency of about 10 Hz onto the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50), collecting a portion of the radiation (R1-R9) reflected from the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50), measuring an intensity of wavelengths in a spectrum of the radiation (R1-R9) reflected from the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50), and using a correlation between a spectral position of a minimum in the spectrum and a width of the structures (250, Figure 9A-B, Paragraphs 88, 91 and 94) formed on the substrate (75, 200, Figure 1A-B, 3A, Paragraphs 34 and 50), and (f) terminating the trim process when the etch process monitoring indicates that the mask (210, Figure 3A, 9A-B, Paragraphs 48-53) has been trimmed to pre-determined dimensions (216, Figures Figure 3B, Paragraphs 41, 55, 58 and 60).